

SEQUENCE LISTING

<110> Mohnen, Debra  
Sterling, Jason D.  
Doong, Ron L.  
Kolli, Venkata S.K.  
Hahn, Michael G.

<120> Galacturonosyltransferases, nucleic acids encoding same, and uses therefor

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<140> Not assigned yet

<141> 2005-08-02

<150> PCT/US2004/003545

<151> 2004-02-05

<150> US 60/445,539

<151> 2003-02-06

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<170> PatentIn version 3.2

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gcgggtgaca tcgaacaagc ggcagttata cactacgtg gggcatgaa gccgtggtg	1680
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Ser Ile Thr Pro Val Gly Arg Arg Glu Phe Ile Glu Glu Leu Ser Lys		
35	40	45

Ile Arg Phe Thr Thr Asn Asp Leu Arg Leu Ser Ala Ile Glu His Glu		
50	55	60

Asp Gly Glu Gly Leu Lys Gly Pro Arg Leu Ile Leu Phe Lys Asp Gly			
65	70	75	80

Glu Phe Asn Ser Ser Ala Glu Ser Asp Gly Gly Asn Thr Tyr Lys Asn		
85	90	95

Arg Glu Glu Gln Val Ile Val Ser Gln Lys Met Thr Val Ser Ser Asp		
100	105	110

Glu Lys Gly Gln Ile Leu Pro Thr Val Asn Gln Leu Ala Asn Lys Thr		
115	120	125

Asp Phe Lys Pro Pro Leu Ser Lys Gly Glu Lys Asn Thr Arg Val Gln		
130	135	140

Pro Asp Arg Ala Thr Asp Val Lys Thr Lys Glu Ile Arg Asp Lys Ile			
145	150	155	160

Ile Gln Ala Lys Ala Tyr Leu Asn Phe Ala Pro Pro Gly Ser Asn Ser  
165 170 175

Gln Val Val Lys Glu Leu Arg Gly Arg Leu Lys Glu Leu Glu Arg Ser  
180 185 190

Val Gly Asp Ala Thr Lys Asp Lys Asp Leu Ser Lys Gly Ala Leu Arg  
195 200 205

Arg Val Lys Pro Met Glu Asn Val Leu Tyr Lys Ala Ser Arg Val Phe  
210 215 220

Asn Asn Cys Pro Ala Ile Ala Thr Lys Leu Arg Ala Met Asn Tyr Asn  
225 230 235 240

Thr Glu Glu Gln Val Gln Ala Gln Lys Asn Gln Ala Ala Tyr Leu Met  
245 250 255

Gln Leu Ala Ala Arg Thr Thr Pro Lys Gly Leu His Cys Leu Ser Met  
260 265 270

Arg Leu Thr Ser Glu Tyr Phe Ser Leu Asp Pro Glu Lys Arg Gln Met  
275 280 285

Pro Asn Gln Gln Asn Tyr Phe Asp Ala Asn Phe Asn His Tyr Val Val  
290 295 300

Phe Ser Asp Asn Val Leu Ala Ser Ser Val Val Val Asn Ser Thr Ile  
305 310 315 320

Ser Ser Ser Lys Glu Pro Glu Arg Ile Val Phe His Val Val Thr Asp  
325 330 335

Ser Leu Asn Tyr Pro Ala Ile Ser Met Trp Phe Leu Leu Asn Ile Gln  
340 345 350

Ser Lys Ala Thr Ile Gln Ile Leu Asn Ile Asp Asp Met Asp Val Leu  
355 360 365

Pro Arg Asp Tyr Asp Gln Leu Leu Met Lys Gln Asn Ser Asn Asp Pro  
370 375 380

Arg Phe Ile Ser Thr Leu Asn His Ala Arg Phe Tyr Leu Pro Asp Ile  
385 390 395 400

Phe Pro Gly Leu Asn Lys Met Val Leu Leu Asp His Asp Val Val Val  
405 410 415

Gln Arg Asp Leu Ser Arg Leu Trp Ser Ile Asp Met Lys Gly Lys Val  
420 425 430

Val Gly Ala Val Glu Thr Cys Leu Glu Gly Glu Ser Ser Phe Arg Ser  
435 440 445

Met Ser Thr Phe Ile Asn Phe Ser Asp Thr Trp Val Ala Gly Lys Phe  
450 455 460

Ser Pro Arg Ala Cys Thr Trp Ala Phe Gly Met Asn Leu Ile Asp Leu  
465 470 475 480

Glu Glu Trp Arg Ile Arg Lys Leu Thr Ser Thr Tyr Ile Lys Tyr Phe  
485 490 495

Asn Leu Gly Thr Lys Arg Pro Leu Trp Lys Ala Gly Ser Leu Pro Ile  
500 505 510

Gly Trp Leu Thr Phe Tyr Arg Gln Thr Leu Ala Leu Asp Lys Arg Trp  
515 520 525

His Val Met Gly Leu Gly Arg Glu Ser Gly Val Lys Ala Val Asp Ile  
530 535 540

Glu Gln Ala Ala Val Ile His Tyr Asp Gly Val Met Lys Pro Trp Leu  
545 550 555 560

Asp Ile Gly Lys Glu Asn Tyr Lys Arg Tyr Trp Asn Ile His Val Pro  
565 570 575

Tyr His His Thr Tyr Leu Gln Gln Cys Asn Leu Gln Ala  
580 585

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caccatcaac aagatccatc ccagcttta cttgagagag acacgagaac cgaaatggta 180  
tctcctcccc atttaaactt cacggaagag gtcacaagtg cttcctcctt ctctaggcag 240

Val	Leu	Phe	Ile	Val	Gln	His	Tyr	His	His	Gln	Gln	Asp	Pro	Ser	Gln
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Leu	Leu	Leu	Glu	Arg	Asp	Thr	Arg	Thr	Glu	Met	Val	Ser	Pro	Pro	His
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Leu	Asn	Phe	Thr	Glu	Glu	Val	Thr	Ser	Ala	Ser	Ser	Phe	Ser	Arg	Gln
65						70				75				80	
Leu	Ala	Glu	Gln	Met	Thr	Leu	Ala	Lys	Ala	Tyr	Val	Phe	Ile	Ala	Lys
85								90					95		
Glu	His	Asn	Asn	Leu	His	Leu	Ala	Trp	Glu	Leu	Ser	Ser	Lys	Ile	Arg
								105					110		
Ser	Cys	Gln	Leu	Leu	Leu	Ser	Lys	Ala	Ala	Met	Arg	Gly	Gln	Pro	Ile
								115				120		125	
Ser	Phe	Asp	Glu	Ala	Lys	Pro	Ile	Ile	Thr	Gly	Leu	Ser	Ala	Leu	Ile
							130			135		140			
Tyr	Lys	Ala	Gln	Asp	Ala	His	Tyr	Asp	Ile	Ala	Thr	Thr	Met	Met	Thr
							145			150		155		160	
Met	Lys	Ser	His	Ile	Gln	Ala	Leu	Glu	Glu	Arg	Ala	Asn	Ala	Ala	Thr
							165			170		175			
Val	Gln	Thr	Thr	Ile	Phe	Gly	Gln	Leu	Val	Ala	Glu	Ala	Leu	Pro	Lys
							180			185		190			
Ser	Leu	His	Cys	Leu	Thr	Ile	Lys	Leu	Thr	Ser	Asp	Trp	Val	Thr	Glu
							195			200		205			
Pro	Ser	Arg	His	Glu	Leu	Ala	Asp	Glu	Asn	Arg	Asn	Ser	Pro	Arg	Leu
							210			215		220			
Val	Asp	Asn	Asn	Leu	Tyr	His	Phe	Cys	Ile	Phe	Ser	Asp	Asn	Val	Ile
							225			230		235		240	
Ala	Thr	Ser	Val	Val	Val	Asn	Ser	Thr	Val	Ser	Asn	Ala	Asp	His	Pro
								245			250		255		
Lys	Gln	Leu	Val	Phe	His	Ile	Val	Thr	Asn	Arg	Val	Ser	Tyr	Lys	Ala
								260			265		270		
Met	Gln	Ala	Trp	Phe	Leu	Ser	Asn	Asp	Phe	Lys	Gly	Ser	Ala	Ile	Glu

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gcagctatga	gaggacaacc	tatttcgttt	gatgaggcta	aaccgattat	tactggctca	420
tcagctctta	tctacaaggc	tcaagatgca	cattatgata	ttgccaccac	tatgtatgacc	480
atgaaatctc	acatccaaggc	acttgaagag	cgtgcaaatg	cagctactgt	tcagaccaca	540
atatttggc	aatttgggtgc	tgaggcatta	ccaaagagcc	tccactgttt	gacgataaaag	600
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tataatggta	acatgaagcc	ttggctaaag	ctggctattg	gtaggatataa	acctttctgg	1560
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 <212> PRT  
 <213> *Arabidopsis thaliana*

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275

280

285

Ile Arg Ser Val Glu Glu Phe Ser Trp Leu Asn Ala Ser Tyr Ser Pro  
 290 295 300

Val Val Lys Gln Leu Leu Asp Thr Asp Ala Arg Ala Tyr Tyr Phe Gly  
 305 310 315 320

Glu Gln Thr Ser Gln Asp Thr Ile Ser Glu Pro Lys Val Arg Asn Pro  
 325 330 335

Lys Tyr Leu Ser Leu Leu Asn His Leu Arg Phe Tyr Ile Pro Glu Ile  
 340 345 350

Tyr Pro Gln Leu Glu Lys Ile Val Phe Leu Asp Asp Asp Val Val Val  
 355 360 365

Gln Lys Asp Leu Thr Pro Leu Phe Ser Leu Asp Leu His Gly Asn Val  
 370 375 380

Asn Gly Ala Val Glu Thr Cys Leu Glu Ala Phe His Arg Tyr Tyr Lys  
 385 390 395 400

Tyr Leu Asn Phe Ser Asn Pro Leu Ile Ser Ser Lys Phe Asp Pro Gln  
 405 410 415

Ala Cys Gly Trp Ala Phe Gly Met Asn Val Phe Asp Leu Ile Ala Trp  
 420 425 430

Arg Asn Ala Asn Val Thr Ala Arg Tyr His Tyr Trp Gln Asp Gln Asn  
 435 440 445

Arg Glu Arg Thr Leu Trp Lys Leu Gly Thr Leu Pro Pro Gly Leu Leu  
 450 455 460

Ser Phe Tyr Gly Leu Thr Glu Pro Leu Asp Arg Arg Trp His Val Leu  
 465 470 475 480

Gly Leu Gly Tyr Asp Val Asn Ile Asp Asn Arg Leu Ile Glu Thr Ala  
 485 490 495

Ala Val Ile His Tyr Asn Gly Asn Met Lys Pro Trp Leu Lys Leu Ala  
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Ile Gly Arg Tyr Lys Pro Phe Trp Leu Lys Phe Leu Asn Ser Ser His  
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Pro Tyr Leu Gln Asp Cys Val Thr Ala  
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tctggacaca acgatgatgg ggcactcca atcaaattca ggaacccaa gatatcc         1020  
atgctcaacc atcttaggtt ctacatccct gaagtgttc ctgcgcgtgaa gaaggtggc         1080  
tttcttgcgt atgatgtgt agttcagaag gatcttcat ctctctttc gatcgattta         1140  
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taccactact ggcaagaaaa aaacgtggac cggaccttat gaaactggg aacactacct         1380  
ccaggacttc tgacattta cgggttaaca gaggcactag aggcgtcctg gcatatcctg         1440  
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aatgggaact taaagccatg gttgaagatc gggatagaga agtacaaacc tttgtggag 1560  
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 <213> *Arabidopsis thaliana*

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Phe Phe Leu Ile Leu Ser Lys Ala Gly His Ile Glu Pro Arg Pro Ser  
 35 40 45

Ile Pro Lys Arg Arg Tyr Arg Asn Asp Lys Phe Val Glu Gly Met Asn  
 50 55 60

Met Thr Glu Glu Met Leu Ser Pro Thr Ser Val Ala Arg Gln Val Asn  
 65 70 75 80

Asp Gln Ile Ala Leu Ala Lys Ala Phe Val Val Ile Ala Lys Glu Ser  
 85 90 95

Lys Asn Leu Gln Phe Ala Trp Asp Leu Ser Ala Gln Ile Arg Asn Ser  
 100 105 110

Gln Leu Leu Leu Ser Ser Ala Ala Thr Arg Arg Ser Pro Leu Thr Val  
 115 120 125

Leu Glu Ser Glu Ser Thr Ile Arg Asp Met Ala Val Leu Leu Tyr Gln  
 130 135 140

Ala Gln Gln Leu His Tyr Asp Ser Ala Thr Met Ile Met Arg Leu Lys  
 145 150 155 160

Ala Ser Ile Gln Ala Leu Glu Glu Gln Met Ser Ser Val Ser Glu Lys  
 165 170 175

Ser Ser Lys Tyr Gly Gln Ile Ala Ala Glu Glu Val Pro Lys Ser Leu  
 180 185 190

Tyr Cys Leu Gly Val Arg Leu Thr Thr Glu Trp Phe Gln Asn Leu Asp  
195 200 205

Leu Gln Arg Thr Leu Lys Glu Arg Ser Arg Val Asp Ser Lys Leu Thr  
210 215 220

Asp Asn Ser Leu Tyr His Phe Cys Val Phe Ser Asp Asn Ile Ile Ala  
225 230 235 240

Thr Ser Val Val Val Asn Ser Thr Ala Leu Asn Ser Lys Ala Pro Glu  
245 250 255

Lys Val Val Phe His Leu Val Thr Asn Glu Ile Asn Tyr Ala Ala Met  
260 265 270

Lys Ala Trp Phe Ala Ile Asn Met Asp Asn Leu Arg Gly Val Thr Val  
275 280 285

Glu Val Gln Lys Phe Glu Asp Phe Ser Trp Leu Asn Ala Ser Tyr Val  
290 295 300

Pro Val Leu Lys Gln Leu Gln Asp Ser Asp Thr Gln Ser Tyr Tyr Phe  
305 310 315 320

Ser Gly His Asn Asp Asp Gly Arg Thr Pro Ile Lys Phe Arg Asn Pro  
325 330 335

Lys Tyr Leu Ser Met Leu Asn His Leu Arg Phe Tyr Ile Pro Glu Val  
340 345 350

Phe Pro Ala Leu Lys Lys Val Val Phe Leu Asp Asp Asp Val Val Val  
355 360 365

Gln Lys Asp Leu Ser Ser Leu Phe Ser Ile Asp Leu Asn Lys Asn Val  
370 375 380

Asn Gly Ala Val Glu Thr Cys Met Glu Thr Phe His Arg Tyr His Lys

Tyr Leu Asn Tyr Ser His Pro Leu Ile Arg Ser His Phe Asp Pro Asp  
405 410 415

Ala Cys Gly Trp Ala Phe Gly Met Asn Val Phe Asp Leu Val Glu Trp  
420 425 430

Arg Lys Arg Asn Val Thr Gly Ile Tyr His Tyr Trp Gln Glu Lys Asn  
435 440 445

Val Asp Arg Thr Leu Trp Lys Leu Gly Thr Leu Pro Pro Gly Leu Leu  
450 455 460

Thr Phe Tyr Gly Leu Thr Glu Ala Leu Glu Ala Ser Trp His Ile Leu  
465 470 475 480

Gly Leu Gly Tyr Thr Asn Val Asp Ala Arg Val Ile Glu Lys Gly Ala  
485 490 495

Val Leu His Phe Asn Gly Asn Leu Lys Pro Trp Leu Lys Ile Gly Ile  
500 505 510

Glu Lys Tyr Lys Pro Leu Trp Glu Arg Tyr Val Asp Tyr Thr Ser Pro  
515 520 525

Phe Met Gln Gln Cys Asn Phe His  
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gaattcattt aagaatttac cgacattaca gataagaccg agatgaact tagacttact 180  
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gcaagagata ttcaacttac tcataaaacg gaattccgac ccccttcaag taagagtcaa 480  
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gcagcaagga ctacccaaa agggcttcat tgtctctcaa tgcgggttgac aacagaatat 900

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 <212> PRT  
 <213> *Arabidopsis thaliana*

<400> 14

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20	25	30

Ser Ile Thr Ser Val Asp Arg Gly Glu Phe Ile Glu Glu Leu Ser Asp		
35	40	45

Ile Thr Asp Lys Thr Glu Asp Glu Leu Arg Leu Thr Ala Ile Glu Gln		
50	55	60

Asp Glu Glu Gly Leu Lys Glu Pro Lys Arg Ile Leu Gln Asp Arg Asp			
65	70	75	80

Phe Asn Ser Val Val Leu Ser Asn Ser Ser Asp Lys Ser Asn Asp Thr

85

90

95

Val Gln Ser Asn Glu Gly Asp Gln Lys Asn Phe Leu Ser Glu Val Asp  
 100 105 110

Lys Gly Asn Asn His Lys Pro Lys Glu Glu Gln Ala Val Ser Gln Lys  
 115 120 125

Thr Thr Val Ser Ser Asn Ala Glu Val Lys Ile Ser Ala Arg Asp Ile  
 130 135 140

Gln Leu Asn His Lys Thr Glu Phe Arg Pro Pro Ser Ser Lys Ser Glu  
 145 150 155 160

Lys Asn Thr Arg Val Gln Leu Glu Arg Ala Thr Asp Glu Arg Val Lys  
 165 170 175

Glu Ile Arg Asp Lys Ile Ile Gln Ala Lys Ala Tyr Leu Asn Leu Ala  
 180 185 190

Leu Pro Gly Asn Asn Ser Gln Ile Val Lys Glu Leu Arg Val Arg Thr  
 195 200 205

Lys Glu Leu Glu Arg Ala Thr Gly Asp Thr Thr Lys Asp Lys Tyr Leu  
 210 215 220

Pro Lys Ser Ser Pro Asn Arg Leu Lys Ala Met Glu Val Ala Leu Tyr  
 225 230 235 240

Lys Val Ser Arg Ala Phe His Asn Cys Pro Ala Ile Ala Thr Lys Leu  
 245 250 255

Gln Ala Met Thr Tyr Lys Thr Glu Glu Gln Ala Arg Ala Gln Lys Lys  
 260 265 270

Gln Ala Ala Tyr Leu Met Gln Leu Ala Ala Arg Thr Thr Pro Lys Gly  
 275 280 285

Leu His Cys Leu Ser Met Arg Leu Thr Thr Glu Tyr Phe Thr Leu Asp  
 290 295 300

His Glu Lys Arg Gln Leu Leu Gln Gln Ser Tyr Asn Asp Pro Asp Leu  
 305 310 315 320

Tyr His Tyr Val Val Phe Ser Asp Asn Val Leu Ala Ser Ser Val Val  
 325 330 335

Val Asn Ser Thr Ile Ser Ser Ser Lys Glu Pro Asp Lys Ile Val Phe  
340 345 350

His Val Val Thr Asp Ser Leu Asn Tyr Pro Ala Ile Ser Met Trp Phe  
355 360 365

Leu Leu Asn Pro Ser Gly Arg Ala Ser Ile Gln Ile Leu Asn Ile Asp  
370 375 380

Glu Met Asn Val Leu Pro Leu Tyr His Ala Glu Leu Leu Met Lys Gln  
385 390 395 400

Asn Ser Ser Asp Pro Arg Ile Ile Ser Ala Leu Asn His Ala Arg Phe  
405 410 415

Tyr Leu Pro Asp Ile Phe Pro Gly Leu Asn Lys Ile Val Leu Phe Asp  
420 425 430

His Asp Val Val Val Gln Arg Asp Leu Thr Arg Leu Trp Ser Leu Asp  
435 440 445

Met Thr Gly Lys Val Val Gly Ala Val Glu Thr Cys Leu Glu Gly Asp  
450 455 460

Pro Ser Tyr Arg Ser Met Asp Ser Phe Ile Asn Phe Ser Asp Ala Trp  
465 470 475 480

Val Ser Gln Lys Phe Asp Pro Lys Ala Cys Thr Trp Ala Phe Gly Met  
485 490 495

Asn Leu Phe Asp Leu Glu Glu Trp Arg Arg Gln Glu Leu Thr Ser Val  
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Tyr Leu Lys Tyr Phe Asp Leu Gly Val Lys Gly His Leu Trp Lys Ala  
515 520 525

Gly Gly Leu Pro Val Gly Trp Leu Thr Phe Phe Gly Gln Thr Phe Pro  
530 535 540

Leu Glu Lys Arg Trp Asn Val Gly Gly Leu Gly His Glu Ser Gly Leu  
545 550 555 560

Arg Ala Ser Asp Ile Glu Gln Ala Ala Val Ile His Tyr Asp Gly Ile  
565 570 575

Met Lys Pro Trp Leu Asp Ile Gly Ile Asp Lys Tyr Lys Arg Tyr Trp  
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His Asp  
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Ala Met Ala Arg Ser Arg Ser Val Asp Ser Ala Pro Leu Gly Asn Tyr  
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Leu Arg Leu Met Gln Asp Gln Ile Ile Met Ala Arg Val Tyr Ser Gly  
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Leu Ala Lys Phe Thr Asn Asn Leu Ala Leu His Gln Glu Ile Glu Thr  
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Gln Leu Met Lys Leu Ala Trp Glu Glu Ser Thr Asp Ile Asp Gln  
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Glu Gln Arg Val Leu Asp Ser Ile Arg Asp Met Gly Gln Ile Leu Ala  
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Arg Ala His Glu Gln Leu Tyr Glu Cys Lys Leu Val Thr Asn Lys Leu  
165 170 175

Arg Ala Met Leu Gln Thr Val Glu Asp Glu Leu Glu Asn Glu Gln Thr  
180 185 190

Tyr Ile Thr Phe Leu Thr Gln Leu Ala Ser Lys Ala Leu Pro Asp Ala  
195 200 205

Ile His Cys Leu Thr Met Arg Leu Asn Leu Glu Tyr His Leu Leu Pro  
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Leu Pro Met Arg Asn Phe Pro Arg Arg Glu Asn Leu Glu Asn Pro Lys  
225 230 235 240

Leu Tyr His Tyr Ala Leu Phe Ser Asp Asn Val Leu Ala Ala Ser Val  
245 250 255

Val Val Asn Ser Thr Val Met Asn Ala Gln Asp Pro Ser Arg His Val  
260 265 270

Phe His Leu Val Thr Asp Lys Leu Asn Phe Gly Ala Met Ser Met Trp  
275 280 285

Phe Leu Leu Asn Pro Pro Gly Glu Ala Thr Ile His Val Gln Arg Phe  
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Glu Asp Phe Thr Trp Leu Asn Ser Ser Tyr Ser Pro Val Leu Ser Gln  
305 310 315 320

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325 330 335

Glu Ser Val Glu Ser Gly Ser Glu Asn Leu Lys Tyr Arg Tyr Pro Lys  
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Tyr Met Ser Met Leu Asn His Leu Arg Phe Tyr Ile Pro Arg Ile Phe  
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Pro Lys Leu Glu Lys Ile Leu Phe Val Asp Asp Asp Val Val Val Gln  
370 375 380

Lys Asp Leu Thr Pro Leu Trp Ser Ile Asp Leu Lys Gly Lys Val Asn  
385 390 395 400

Glu Asn Phe Asp Pro Lys Phe Cys Gly Trp Ala Tyr Gly Met Asn Ile  
405 410 415

Phe Asp Leu Lys Glu Trp Lys Lys Asn Asn Ile Thr Glu Thr Tyr His  
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435 440 445

Leu Pro Pro Gly Leu Ile Thr Phe Tyr Asn Leu Thr Gln Pro Leu Gln  
450 455 460

Arg Lys Trp His Leu Leu Gly Leu Gly Tyr Asp Lys Gly Ile Asp Val  
465 470 475 480

Lys Lys Ile Glu Arg Ser Ala Val Ile His Tyr Asn Gly His Met Lys  
485 490 495

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<213> Arabidopsis thaliana

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Asn Lys Cys Ser Ser Phe Asp Cys Phe Gly Arg Arg Leu Gly Pro Arg			
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Leu Leu Gly Arg Ile Asp Asp Ser Glu Gln Arg Leu Val Arg Asp Phe			
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Tyr Lys Ile Leu Asn Glu Val Ser Thr Gln Glu Ile Pro Asp Gly Leu			
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Lys Leu Pro Glu Ser Phe Ser Gln Leu Val Ser Asp Met Lys Asn Asn  
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His Tyr Asp Ala Lys Thr Phe Ala Leu Val Phe Arg Ala Met Val Glu  
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Lys Phe Glu Arg Asp Leu Arg Glu Ser Lys Phe Ala Glu Leu Met Asn  
145 150 155 160

Lys His Phe Ala Ala Ser Ser Ile Pro Lys Gly Ile His Cys Leu Ser  
165 170 175

Leu Arg Leu Thr Asp Glu Tyr Ser Ser Asn Ala His Ala Arg Arg Gln  
180 185 190

Leu Pro Ser Pro Glu Leu Leu Pro Val Leu Ser Asp Asn Ala Tyr His  
195 200 205

His Phe Val Leu Ala Thr Asp Asn Ile Leu Ala Ala Ser Val Val Val  
210 215 220

Ser Ser Ala Val Gln Ser Ser Ser Lys Pro Glu Lys Ile Val Phe His  
225 230 235 240

Val Ile Thr Asp Lys Lys Thr Tyr Ala Gly Met His Ser Trp Phe Ala  
245 250 255

Leu Asn Ser Val Ala Pro Ala Ile Val Glu Val Lys Ser Val His Gln  
260 265 270

Phe Asp Trp Leu Thr Arg Glu Asn Val Pro Val Leu Glu Ala Val Glu  
275 280 285

Ser His Asn Ser Ile Arg Asn Tyr Tyr His Gly Asn His Ile Ala Gly  
290 295 300

Ala Asn Leu Ser Glu Thr Thr Pro Arg Thr Phe Ala Ser Lys Leu Gln  
305 310 315 320

Ser Arg Ser Pro Lys Tyr Ile Ser Leu Leu Asn His Leu Arg Ile Tyr  
325 330 335

Leu Pro Glu Leu Phe Pro Asn Leu Asp Lys Val Val Phe Leu Asp Asp  
340 345 350

Asp Ile Val Ile Gln Lys Asp Leu Ser Pro Leu Trp Asp Ile Asp Leu  
355 360 365

Asn Gly Lys Val Asn Gly Ala Val Glu Thr Cys Arg Gly Glu Asp Val  
370 375 380

Trp Val Met Ser Lys Arg Leu Arg Asn Tyr Phe Asn Phe Ser His Pro  
385 390 395 400

Leu Ile Ala Lys His Leu Asp Pro Glu Glu Cys Ala Trp Ala Tyr Gly  
405 410 415

Met Asn Ile Phe Asp Leu Arg Thr Trp Arg Lys Thr Asn Ile Arg Glu  
420 425 430

Thr Tyr His Ser Trp Leu Lys Glu Asn Leu Lys Ser Asn Leu Thr Met  
435 440 445

Trp Lys Leu Gly Thr Leu Pro Pro Ala Leu Ile Ala Phe Lys Gly His  
450 455 460

Val Gln Pro Ile Asp Ser Ser Trp His Met Leu Gly Leu Gly Tyr Gln  
465 470 475 480

Ser Lys Thr Asn Leu Glu Asn Ala Lys Lys Ala Ala Val Ile His Tyr  
485 490 495

Asn Gly Gln Ser Lys Pro Trp Leu Glu Ile Gly Phe Glu His Leu Arg  
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Asp Lys Ser Trp His Val Leu Gly Leu Gly Tyr Asn Pro Gly Val Ser  
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Met Asp Glu Ile Arg Asn Ala Gly Val Ile His Tyr Asn Gly Asn Met  
515 520 525

Lys Pro Trp Leu Asp Ile Ala Met Asn Gln Tyr Lys Ser Leu Trp Thr  
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<212> DNA  
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<211> 559

<212> PRT

<213> *Arabidopsis thaliana*

<400> 22

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Ile Gly Gly Arg Ile Thr Leu Thr Ala Phe Ala Ser Thr Ile Ala Leu  
 20 25 30

Phe Leu Phe Thr Leu Ser Phe Phe Ala Ser Asp Ser Asn Asp Ser  
 35 40 45

Pro Asp Leu Leu Leu Pro Gly Val Glu Tyr Ser Asn Gly Val Gly Ser  
 50 55 60

Arg Arg Ser Met Leu Asp Ile Lys Ser Asp Pro Leu Lys Pro Arg Leu  
 65 70 75 80

Ile Gln Ile Arg Lys Gln Ala Asp Asp His Arg Ser Leu Ala Leu Ala  
 85 90 95

Tyr Ala Ser Tyr Ala Arg Lys Leu Lys Leu Glu Asn Ser Lys Leu Val  
 100 105 110

Arg Ile Phe Ala Asp Leu Ser Arg Asn Tyr Thr Asp Leu Ile Asn Lys  
 115 120 125

Pro Thr Tyr Arg Ala Leu Tyr Asp Ser Asp Gly Ala Ser Ile Glu Glu  
 130 135 140

Ser Val Leu Arg Gln Phe Glu Lys Glu Val Lys Glu Arg Ile Lys Met  
145 150 155 160

Thr Arg Gln Val Ile Ala Glu Ala Lys Glu Ser Phe Asp Asn Gln Leu  
165 170 175

Lys Ile Gln Lys Leu Lys Asp Thr Ile Phe Ala Val Asn Glu Gln Leu  
180 185 190

Thr Asn Ala Lys Lys Gln Gly Ala Phe Ser Ser Leu Ile Ala Ala Lys  
195 200 205

Ser Ile Pro Lys Gly Leu His Cys Leu Ala Met Arg Leu Met Glu Glu  
210 215 220

Arg Ile Ala His Pro Glu Lys Tyr Thr Asp Glu Gly Lys Asp Arg Pro  
225 230 235 240

Arg Glu Leu Glu Asp Pro Asn Leu Tyr His Tyr Ala Ile Phe Ser Asp  
245 250 255

Asn Val Ile Ala Ala Ser Val Val Val Asn Ser Ala Val Lys Asn Ala  
260 265 270

Lys Glu Pro Trp Lys His Val Phe His Val Val Thr Asp Lys Met Asn  
275 280 285

Leu Gly Ala Met Gln Val Met Phe Lys Leu Lys Glu Tyr Lys Gly Ala  
290 295 300

His Val Glu Val Lys Ala Val Glu Asp Tyr Thr Phe Leu Asn Ser Ser  
305 310 315 320

Tyr Val Pro Val Leu Lys Gln Leu Glu Ser Ala Asn Leu Gln Lys Phe  
325 330 335

Tyr Phe Glu Asn Lys Leu Glu Asn Ala Thr Lys Asp Thr Thr Asn Met  
340 345 350

Lys Phe Arg Asn Pro Lys Tyr Leu Ser Ile Leu Asn His Leu Arg Phe  
355 360 365

Tyr Leu Pro Glu Met Tyr Pro Lys Leu His Arg Ile Leu Phe Leu Asp  
370 375 380

Asp Asp Val Val Gln Lys Asp Leu Thr Gly Leu Trp Glu Ile Asp  
385 390 395 400

Met Asp Gly Lys Val Asn Gly Ala Val Glu Thr Cys Phe Gly Ser Phe  
405 410 415

His Arg Tyr Ala Gln Tyr Met Asn Phe Ser His Pro Leu Ile Lys Glu  
420 425 430

Lys Phe Asn Pro Lys Ala Cys Ala Trp Ala Tyr Gly Met Asn Phe Phe  
435 440 445

Asp Leu Asp Ala Trp Arg Arg Glu Lys Cys Thr Glu Glu Tyr His Tyr  
450 455 460

Trp Gln Asn Leu Asn Glu Asn Arg Ala Leu Trp Lys Leu Gly Thr Leu  
465 470 475 480

Pro Pro Gly Leu Ile Thr Phe Tyr Ser Thr Thr Lys Pro Leu Asp Lys  
485 490 495

Ser Trp His Val Leu Gly Leu Gly Tyr Asn Pro Ser Ile Ser Met Asp  
500 505 510

Glu Ile Arg Asn Ala Ala Val Val His Phe Asn Gly Asn Met Lys Pro  
515 520 525

Trp Leu Asp Ile Ala Met Asn Gln Phe Arg Pro Leu Trp Thr Lys His  
530 535 540

Val Asp Tyr Asp Leu Glu Phe Val Gln Ala Cys Asn Phe Gly Leu  
545 550 555

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<213> Arabidopsis thaliana

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acacgggctc	tagtggaga	gacgacagat	catcaggacg	ttaatggaa	aggaacgaag	360
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agggcg	tttg	cttc	cgac	taagaagatg	ctgtgc	480
gcgaa	acatc	atgagtt	gtactgg	cat	ttagc	540
cattgc	cttt	ccctc	agatt	aactgaa	gag	600
ttgc	cctcc	gtg	actcc	atc	acgtct	660
ctgactgaca	atgtc	c	c	tg	cgt	720
aatccc	gaga	agttt	gtc	tat	ttgt	780
gcttg	gtt	tt	caactc	tg	ttcatca	840
tatgatt	ggc	ctcaaga	agt	tttgc	accgataa	900
atttg	gag	acttca	aa	ttgttgc	gaa	960
catgagc	agt	c	ttgc	aaatc	ttgttgc	1020
atttacat	tc	caag	tttt	tcc	atctc	1080
gttagtac	aga	tttc	gtt	ccatc	ccatc	1140
gctgtcg	ttt	tttgc	tttgc	tttgc	tttgc	1200
ttcaactt	cacat	c	c	tttgc	tttgc	1260
tctgg	tttgc	tttgc	tttgc	tttgc	tttgc	1320
tctacat	ggc	taa	actc	tttgc	tttgc	1380
ccacc	gacat	tac	tgc	tttgc	tttgc	1440
gctgg	acta	gtt	tcgatc	tttgc	tttgc	1500
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Asn Pro Gly Val Gly Ile Gly Lys Gly Ser Gly Gly Cys Ala Ala Ala  
 20 25 30

Ala Ala Ala Leu Ala Ala Arg Arg Phe Ser Ser Arg Thr Leu Leu Leu  
35 40 45

Leu Leu Leu Leu Leu Ala Ile Val Leu Pro Phe Ile Phe Val Arg Phe  
50 55 60

Ala Phe Leu Val Leu Glu Ser Ala Ser Val Cys Asp Ser Pro Leu Asp  
65 70 75 80

Cys Met Gly Leu Arg Leu Phe Arg Gly Gly Asp Thr Ser Leu Lys Ile  
85 90 95

Gly Glu Glu Leu Thr Arg Ala Leu Val Glu Glu Thr Thr Asp His Gln  
100 105 110

Asp Val Asn Gly Arg Gly Thr Lys Gly Ser Leu Glu Ser Phe Asp Asp  
115 120 125

130 135 140

Ser Val Thr Lys Lys Met Leu Leu Gln Met Glu Arg Lys Val Gln Ser  
145 150 155 160

Ala Lys His His Glu Leu Val Tyr Trp His Leu Ala Ser His Gly Ile  
165 170 175

Pro Lys Ser Leu His Cys Leu Ser Leu Arg Leu Thr Glu Glu Tyr Ser  
180 185 190

Val Asn Ala Met Ala Arg Met Arg Leu Pro Pro Pro Glu Ser Val Ser  
195 200 205

Arg Leu Thr Asp Pro Ser Phe His His Ile Val Leu Leu Thr Asp Asn  
210 215 220

Val Leu Ala Ala Ser Val Val Ile Ser Ser Thr Val Gln Asn Ala Val  
225 230 235 240

Asn Pro Glu Lys Phe Val Phe His Ile Val Thr Asp Lys Lys Thr Tyr  
245 250 255

Thr Pro Met His Ala Trp Phe Ala Ile Asn Ser Ala Ser Ser Pro Val  
260 265 270

Val Glu Val Lys Gly Leu His Gln Tyr Asp Trp Pro Gln Glu Val Asn  
275 280 285

Phe Lys Val Arg Glu Met Leu Asp Ile His Arg Leu Ile Trp Arg Arg  
290 295 300

His Tyr Gln Asn Leu Lys Asp Ser Asp Phe Ser Phe Val Glu Gly Thr  
305 310 315 320

His Glu Gln Ser Leu Gln Ala Leu Asn Pro Ser Cys Leu Ala Leu Leu  
325 330 335

Asn His Leu Arg Ile Tyr Ile Pro Lys Leu Phe Pro Asp Leu Asn Lys  
340 345 350

Ile Val Leu Leu Asp Asp Asp Val Val Val Gln Ser Asp Leu Ser Ser  
355 360 365

Leu Trp Glu Thr Asp Leu Asn Gly Lys Val Val Gly Ala Val Val Asp  
370 375 380

Ser Trp Cys Gly Asp Asn Cys Cys Pro Gly Arg Lys Tyr Lys Asp Tyr  
385 390 395 400

Phe Asn Phe Ser His Pro Leu Ile Ser Ser Asn Leu Val Gln Glu Asp  
405 410 415

Cys Ala Trp Leu Ser Gly Met Asn Val Phe Asp Leu Lys Ala Trp Arg  
420 425 430

Gln Thr Asn Ile Thr Glu Ala Tyr Ser Thr Trp Leu Arg Leu Ser Val  
435 440 445

Arg Ser Gly Leu Gln Leu Trp Gln Pro Gly Ala Leu Pro Pro Thr Leu  
450 455 460

Leu Ala Phe Lys Gly Leu Thr Gln Ser Leu Glu Pro Ser Trp His Val  
465 470 475 480

Ala Gly Leu Gly Ser Arg Ser Val Lys Ser Pro Gln Glu Ile Leu Lys  
485 490 495

Ser Ala Ser Val Leu His Phe Ser Gly Pro Ala Lys Pro Trp Leu Glu  
500 505 510

Ile Ser Asn Pro Glu Val Arg Ser Leu Trp Tyr Arg Tyr Val Asn Ser  
515 520 525

Ser Asp Ile Phe Val Arg Lys Cys Lys Ile Met Asn  
530 535 540

<210> 25  
<211> 2043  
<212> DNA  
<213> *Arabidopsis thaliana*

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ccgctgcaag ataataatct acaggaggtg tatgcttcct cagctgctgc agtgcactac 180  
gatccagatc tgaaagatgt gaacatagtt gcgacataca gtgaccatta cggcaatata 240  
cgccctggta gggtgaaaat gggggatctt tcacccctt gggtttgga gaatcctgcc 300  
tatcaagtta gccgcaaaac aaaaggttcg cagctagttt taccacggga ttcatttcaa 360  
aatgatactg gaatggaaga taatgcaagc cattctacaa ctaatcagac tgatgaaagc 420  
gaaaatcagt ttccaaacgt ggattttgca agcccagcaa aactgaagcg gcagatttt 480  
cgtcaggaaa ggagaggtca acgaacttta gagctgatcc gacaagaaaa ggaaactgat 540  
gagcagatgc aagaagcagc cattcagaag tcaatgagct ttgaaaactc agtcataggg 600  
aaatacagta tatggaggag agactatgag agcccaaatg ctgatgctat cttgaagctt 660  
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accaatctgt acgtttctt gatgcagcag tgtggagaaa ataaacgtgt tataggtaaa 780  
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gacatgcaag	gaaaagtcaa	tggtgccgtg	gagacgtgca	aggagagctt	ccacagatt	1620
gacaagtacc	tcaacttctc	aaatccaaag	atttcagaga	attttgacgc	tggtgcttgt	1680
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gtactaggc	tggatatga	cccagcgcta	aaccaaacag	caatagagaa	tgcagcggt	1920
gtgcattaca	atggaaacta	caagccatgg	ctgggttag	cattcgccaa	gtacaaaccg	1980
tactggtcca	agtacgttga	gtacgacaac	ccttatctcc	gacggtgcga	catcaatgaa	2040
tga						2043

<210> 26

<211> 680

<212> PRT

<213> *Arabidopsis thaliana*

<400> 26

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										20			25		30

His	Arg	Glu	Leu	Lys	Ala	Tyr	Arg	Pro	Leu	Gln	Asp	Asn	Asn	Leu	Gln
										35			40		45

Glu	Val	Tyr	Ala	Ser	Ser	Ala	Ala	Ala	Val	His	Tyr	Asp	Pro	Asp	Leu
										50			55		60

Lys	Asp	Val	Asn	Ile	Val	Ala	Thr	Tyr	Ser	Asp	His	Tyr	Gly	Asn	Ile
										65			70		80

Arg	Leu	Gly	Arg	Val	Lys	Met	Gly	Asp	Leu	Ser	Pro	Ser	Trp	Val	Leu
										85			90		95

Glu	Asn	Pro	Ala	Tyr	Gln	Val	Ser	Arg	Lys	Thr	Lys	Gly	Ser	Gln	Leu
										100			105		110

Val	Ile	Pro	Arg	Asp	Ser	Phe	Gln	Asn	Asp	Thr	Gly	Met	Glu	Asp	Asn
										115			120		125

Ala Ser His Ser Thr Thr Asn Gln Thr Asp Glu Ser Glu Asn Gln Phe  
130 135 140

Pro Asn Val Asp Phe Ala Ser Pro Ala Lys Leu Lys Arg Gln Ile Leu  
145 150 155 160

Arg Gln Glu Arg Arg Gly Gln Arg Thr Leu Glu Leu Ile Arg Gln Glu  
165 170 175

Lys Glu Thr Asp Glu Gln Met Gln Glu Ala Ala Ile Gln Lys Ser Met  
180 185 190

Ser Phe Glu Asn Ser Val Ile Gly Lys Tyr Ser Ile Trp Arg Arg Asp  
195 200 205

Tyr Glu Ser Pro Asn Ala Asp Ala Ile Leu Lys Leu Met Arg Asp Gln  
210 215 220

Ile Ile Met Ala Lys Ala Tyr Ala Asn Ile Ala Lys Ser Lys Asn Val  
225 230 235 240

Thr Asn Leu Tyr Val Phe Leu Met Gln Gln Cys Gly Glu Asn Lys Arg  
245 250 255

Val Ile Gly Lys Ala Thr Ser Asp Ala Asp Leu Pro Ser Ser Ala Leu  
260 265 270

Asp Gln Ala Lys Ala Met Gly His Ala Leu Ser Leu Ala Lys Asp Glu  
275 280 285

Leu Tyr Asp Cys His Glu Leu Ala Lys Lys Phe Arg Ala Ile Leu Gln  
290 295 300

Ser Thr Glu Arg Lys Val Asp Gly Leu Lys Lys Lys Gly Thr Phe Leu  
305 310 315 320

Ile Gln Leu Ala Ala Lys Thr Phe Pro Lys Pro Leu His Cys Leu Ser  
325 330 335

Leu Gln Leu Ala Ala Asp Tyr Phe Ile Leu Gly Phe Asn Glu Glu Asp  
340 345 350

Ala Val Lys Glu Asp Val Ser Gln Lys Lys Leu Glu Asp Pro Ser Leu  
355 360 365

Tyr His Tyr Ala Ile Phe Ser Asp Asn Val Leu Ala Thr Ser Val Val  
370 375 380

Val Asn Ser Thr Val Leu Asn Ala Lys Glu Pro Gln Arg His Val Phe  
385 390 395 400

His Ile Val Thr Asp Lys Leu Asn Phe Gly Ala Met Lys Met Trp Phe  
405 410 415

Arg Ile Asn Ala Pro Ala Asp Ala Thr Ile Gln Val Glu Asn Ile Asn  
420 425 430

Asp Phe Lys Trp Leu Asn Ser Ser Tyr Cys Ser Val Leu Arg Gln Leu  
435 440 445

Glu Ser Ala Arg Leu Lys Glu Tyr Tyr Phe Lys Ala Asn His Pro Ser  
450 455 460

Ser Ile Ser Ala Gly Ala Asp Asn Leu Lys Tyr Arg Asn Pro Lys Tyr  
465 470 475 480

Leu Ser Met Leu Asn His Leu Arg Phe Tyr Leu Pro Glu Val Tyr Pro  
485 490 495

Lys Leu Glu Lys Ile Leu Phe Leu Asp Asp Asp Ile Val Val Gln Lys  
500 505 510

Asp Leu Ala Pro Leu Trp Glu Ile Asp Met Gln Gly Lys Val Asn Gly  
515 520 525

Ala Val Glu Thr Cys Lys Glu Ser Phe His Arg Phe Asp Lys Tyr Leu  
530 535 540

Asn Phe Ser Asn Pro Lys Ile Ser Glu Asn Phe Asp Ala Gly Ala Cys  
545 550 555 560

Gly Trp Ala Phe Gly Met Asn Met Phe Asp Leu Lys Glu Trp Arg Lys  
565 570 575

Arg Asn Ile Thr Gly Ile Tyr His Tyr Trp Gln Asp Leu Asn Glu Asp  
580 585 590

Arg Thr Leu Trp Lys Leu Gly Ser Leu Pro Pro Gly Leu Ile Thr Phe  
595 600 605

Tyr Asn Leu Thr Tyr Ala Met Asp Arg Ser Trp His Val Leu Gly Leu

610

615

620

Gly Tyr Asp Pro Ala Leu Asn Gln Thr Ala Ile Glu Asn Ala Ala Val  
625 630 635 640

Val His Tyr Asn Gly Asn Tyr Lys Pro Trp Leu Gly Leu Ala Phe Ala  
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Lys Tyr Lys Pro Tyr Trp Ser Lys Tyr Val Glu Tyr Asp Asn Pro Tyr  
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Leu Arg Arg Cys Asp Ile Asn Glu  
675 680

<210> 27  
<211> 1599  
<212> DNA  
<213> Arabidopsis thaliana

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<211> 532

<212> PRT

<213> *Arabidopsis thaliana*

<400> 28

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			20					25					30		

Ile	Ser	Tyr	Arg	Thr	Leu	Phe	His	Thr	Ile	Leu	Ile	Leu	Ala	Phe	Leu
						35		40					45		

Leu	Pro	Phe	Val	Phe	Ile	Leu	Thr	Ala	Val	Val	Thr	Leu	Glu	Gly	Val
			50					55				60			

Asn	Lys	Cys	Ser	Ser	Ile	Asp	Cys	Leu	Gly	Arg	Arg	Ile	Gly	Pro	Arg
	65						70		75				80		

Leu	Leu	Gly	Arg	Val	Asp	Asp	Ser	Glu	Arg	Leu	Ala	Arg	Asp	Phe	Tyr
						85			90				95		

Lys	Ile	Leu	Asn	Glu	Val	Ser	Thr	Gln	Glu	Ile	Pro	Asp	Gly	Leu	Lys
								100				105		110	

Leu	Pro	Asn	Ser	Phe	Ser	Gln	Leu	Val	Ser	Asp	Met	Lys	Asn	Asn	His
								115			120		125		

Tyr	Asp	Ala	Lys	Thr	Phe	Ala	Leu	Val	Leu	Arg	Ala	Met	Met	Glu	Lys
								130			135		140		

Phe Glu Arg Asp Met Arg Glu Ser Lys Phe Ala Glu Leu Met Asn Lys  
145 150 155 160

His Phe Ala Ala Ser Ser Ile Pro Lys Gly Ile His Cys Leu Ser Leu  
165 170 175

Arg Leu Thr Asp Glu Tyr Ser Ser Asn Ala His Ala Arg Arg Gln Leu  
180 185 190

Pro Ser Pro Glu Phe Leu Pro Val Leu Ser Asp Asn Ala Tyr His His  
195 200 205

Phe Ile Leu Ser Thr Asp Asn Ile Leu Ala Ala Ser Val Val Val Ser  
210 215 220

Ser Ala Val Gln Ser Ser Ser Lys Pro Glu Lys Ile Val Phe His Ile  
225 230 235 240

Ile Thr Asp Lys Lys Thr Tyr Ala Gly Met His Ser Trp Phe Ala Leu  
245 250 255

Asn Ser Val Ala Pro Ala Ile Val Glu Val Lys Gly Val His Gln Phe  
260 265 270

Asp Trp Leu Thr Arg Glu Asn Val Pro Val Leu Glu Ala Val Glu Ser  
275 280 285

His Asn Gly Val Arg Asp Tyr Tyr His Gly Asn His Val Ala Gly Ala  
290 295 300

Asn Leu Thr Glu Thr Thr Pro Arg Thr Phe Ala Ser Lys Leu Gln Ser  
305 310 315 320

Arg Ser Pro Lys Tyr Ile Ser Leu Leu Asn His Leu Arg Ile Tyr Ile  
325 330 335

Pro Glu Leu Phe Pro Asn Leu Asp Lys Val Val Phe Leu Asp Asp Asp  
340 345 350

Ile Val Val Gln Gly Asp Leu Thr Pro Leu Trp Asp Val Asp Leu Gly  
355 360 365

Gly Lys Val Asn Gly Ala Val Glu Thr Cys Arg Gly Glu Asp Glu Trp  
370 375 380

Val Met Ser Lys Arg Leu Arg Asn Tyr Phe Asn Phe Ser His Pro Leu  
385 390 395 400

Ile Ala Lys His Leu Asp Pro Glu Glu Cys Ala Trp Ala Tyr Gly Met  
405 410 415

Asn Ile Phe Asp Leu Gln Ala Trp Arg Lys Thr Asn Ile Arg Glu Thr

Tyr His Ser Trp Leu Arg Glu Asn Leu Lys Ser Asn Leu Thr Met Trp  
435 440 445

Lys Leu Gly Thr Leu Pro Pro Ala Leu Ile Ala Phe Lys Gly His Val  
450 455 460

His Ile Ile Asp Ser Ser Trp His Met Leu Gly Leu Gly Tyr Gln Ser  
465 470 475 480

Lys Thr Asn Ile Glu Asn Val Lys Lys Ala Ala Val Ile His Tyr Asn  
485 490 495

Gly Gln Ser Lys Pro Trp Leu Glu Ile Gly Phe Glu His Leu Arg Pro  
500 505 510

Phe Trp Thr Lys Tyr Val Asn Tyr Ser Asn Asp Phe Ile Lys Asn Cys  
515 520 525

His Ile Leu Glu  
530

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<211> 1608  
<212> DNA  
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gaacagcctt taagcgaaca agaactcaaa ggaagatcag atatacctca aacacttcaa 360  
gatttcatgt ctgaagtcaa aagaagcaaa tcagacgcaa gagaatttgc tcaaaagcta 420  
aaagaaaatgg tgacattgat ggaacagaga acaagaacgg ctaagattca agagtattta 480

tatcgacatg tcgcatcaag cagcataccg aaacaacttc actgtttagc tcttaaacta 540  
 gccaacgaac actcgataaa cgccaggcg cgtctccagc ttccagaagc tgagcttgc 600  
 cctatgttgg tagacaacaa ctactttcac tttgtcttgg cttcagacaa tattcttgca 660  
 gcttcgggttg tggctaagtc gttggttcaa aatgctttaa gacctcataa gatcgttctt 720  
 cacatcataa cggataggaa aacttatttc ccaatgcaag cttgggtctc attgcacatcct 780  
 ctgtctccag caataattga ggtcaaggct ttgcatcatt tcgattgggt atcgaaaggt 840  
 aaagtacccg ttttggaaagc tatggagaaa gatcagagag tgaggtctca attcagaggt 900  
 ggatcatcggttattgtggc taataacaaa gagaaccggg ttgttggc tgctaagtta 960  
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 <211> 535  
 <212> PRT  
 <213> *Arabidopsis thaliana*

<400> 30

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Gly Lys Gly Leu Arg Glu Phe Ile Lys Val Lys Val Gly Ser Arg Arg  
20 25 30

Phe Ser Tyr Gln Met Val Phe Tyr Ser Leu Leu Phe Phe Thr Phe Leu  
35 40 45

Leu Arg Phe Val Phe Val Leu Ser Thr Val Asp Thr Ile Asp Gly Asp  
50 55 60

Pro Ser Pro Cys Ser Ser Leu Ala Cys Leu Gly Lys Arg Leu Lys Pro

65

70

75

80

Lys Leu Leu Gly Arg Arg Val Asp Ser Gly Asn Val Pro Glu Ala Met  
85 90 95

Tyr Gln Val Leu Glu Gln Pro Leu Ser Glu Gln Glu Leu Lys Gly Arg  
100 105 110

Ser Asp Ile Pro Gln Thr Leu Gln Asp Phe Met Ser Glu Val Lys Arg  
115 120 125

Ser Lys Ser Asp Ala Arg Glu Phe Ala Gln Lys Leu Lys Glu Met Val  
130 135 140

Thr Leu Met Glu Gln Arg Thr Arg Thr Ala Lys Ile Gln Glu Tyr Leu  
145 150 155 160

Tyr Arg His Val Ala Ser Ser Ile Pro Lys Gln Leu His Cys Leu  
165 170 175

Ala Leu Lys Leu Ala Asn Glu His Ser Ile Asn Ala Ala Arg Leu  
180 185 190

Gln Leu Pro Glu Ala Glu Leu Val Pro Met Leu Val Asp Asn Asn Tyr  
195 200 205

Phe His Phe Val Leu Ala Ser Asp Asn Ile Leu Ala Ala Ser Val Val  
210 215 220

Ala Lys Ser Leu Val Gln Asn Ala Leu Arg Pro His Lys Ile Val Leu  
225 230 235 240

His Ile Ile Thr Asp Arg Lys Thr Tyr Phe Pro Met Gln Ala Trp Phe  
245 250 255

Ser Leu His Pro Leu Ser Pro Ala Ile Ile Glu Val Lys Ala Leu His  
260 265 270

His Phe Asp Trp Leu Ser Lys Gly Lys Val Pro Val Leu Glu Ala Met  
275 280 285

Glu Lys Asp Gln Arg Val Arg Ser Gln Phe Arg Gly Gly Ser Ser Val  
290 295 300

Ile Val Ala Asn Asn Lys Glu Asn Pro Val Val Ala Ala Lys Leu  
305 310 315 320

Gln Ala Leu Ser Pro Lys Tyr Asn Ser Leu Met Asn His Ile Arg Ile  
                  325                 330                 335

His Leu Pro Glu Leu Phe Pro Ser Leu Asn Lys Val Val Phe Leu Asp  
                  340                 345                 350

Asp Asp Ile Val Ile Gln Thr Asp Leu Ser Pro Leu Trp Asp Ile Asp  
                  355                 360                 365

Met Asn Gly Lys Val Asn Gly Ala Val Glu Thr Cys Arg Gly Glu Asp  
                  370                 375                 380

Lys Phe Val Met Ser Lys Lys Phe Lys Ser Tyr Leu Asn Phe Ser Asn  
                  385                 390                 395                 400

Pro Thr Ile Ala Lys Asn Phe Asn Pro Glu Glu Cys Ala Trp Ala Tyr  
                  405                 410                 415

Gly Met Asn Val Phe Asp Leu Ala Ala Trp Arg Arg Thr Asn Ile Ser  
                  420                 425                 430

Ser Thr Tyr Tyr His Trp Leu Asp Glu Asn Leu Lys Ser Asp Leu Ser  
                  435                 440                 445

Leu Trp Gln Leu Gly Thr Leu Pro Pro Gly Leu Ile Ala Phe His Gly  
                  450                 455                 460

His Val Gln Thr Ile Asp Pro Phe Trp His Met Leu Gly Leu Gly Tyr  
                  465                 470                 475                 480

Gln Glu Thr Thr Ser Tyr Ala Asp Ala Glu Ser Ala Ala Val Val His  
                  485                 490                 495

Phe Asn Gly Arg Ala Lys Pro Trp Leu Asp Ile Ala Phe Pro His Leu  
                  500                 505                 510

Arg Pro Leu Trp Ala Lys Tyr Leu Asp Ser Ser Asp Arg Phe Ile Lys  
                  515                 520                 525

Ser Cys His Ile Arg Ala Ser  
                  530                 535

<210> 31  
 <211> 1086  
 <212> DNA

<213> Arabidopsis thaliana

<400> 31  
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gacgaattca aaccctaaca aaactccgat tactcctcct tcagagaatc tccaatgttc 180  
cgtaacgccc aacaatgcag atcttccggc gaagattccg gcgtctgtaa ccctaatttc 240  
gtccacgttag ccatcactct cgacatcgat tacctccgtg gctcaatcgc agccgtcaat 300  
tcgatcctcc agcactcaat gtgcctcaa agcgtttct tccacttcct cgttcctcc 360  
gagtctcaaa acctagaatc tctgattcgt tctactttcc ccaaattgac gaatctcaaa 420  
atttactatt ttgcccctga gaccgtacag tctttgattt catctccgt gagacaagcc 480  
ctagagcaac cggtgaatta cgccagaaat tacttggcgg atctgctcga gccttgcgtt 540  
aagcgagtc tctacttgga ttcggatctc gtcgtcgtcg atgatatcgt caagcttgg 600  
aaaacgggtt taggccagag aacaatcggaa gctccggagt attgtcacgc gaatttcacg 660  
aaatacttca ccggaggtt ttggcagat aagaggtta acgggacgtt caaaggagg 720  
aacccttggtt acttcaatac tggtgtaatg gtgattgatt tgaagaagtg gagacaattt 780  
aggttcacga aacgaattga gaaatggatg gagattcaga agatagagag gatttatgag 840  
cttgggtctc ttccctccgtt tcttctggta tttgctggtc atgtagctcc gatttcacat 900  
cggtggaaatc aacatggct tggtggtgat aatgttagag gtagttgccc tgatttgcac 960  
tctggtcctg tgagtttgct tcactggcga ggttagtgta agccatgggtt aagactcgat 1020  
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cattga 1086

<210> 32

<211> 361

<212> PRT

<213> Arabidopsis thaliana

<400> 32

Met His Trp Ile Thr Arg Phe Ser Ala Phe Phe Ser Ala Ala Leu Ala  
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Met Ile Leu Leu Ser Pro Ser Leu Gln Ser Phe Ser Pro Ala Ala Ala  
20 25 30

Ile Arg Ser Ser His Pro Tyr Ala Asp Glu Phe Lys Pro Gln Gln Asn  
35 40 45

Ser Asp Tyr Ser Ser Phe Arg Glu Ser Pro Met Phe Arg Asn Ala Glu  
50 55 60

Gln Cys Arg Ser Ser Gly Glu Asp Ser Gly Val Cys Asn Pro Asn Leu  
65 70 75 80

Val His Val Ala Ile Thr Leu Asp Ile Asp Tyr Leu Arg Gly Ser Ile  
85 90 95

Ala Ala Val Asn Ser Ile Leu Gln His Ser Met Cys Pro Gln Ser Val  
100 105 110

Phe Phe His Phe Leu Val Ser Ser Glu Ser Gln Asn Leu Glu Ser Leu  
115 120 125

Ile Arg Ser Thr Phe Pro Lys Leu Thr Asn Leu Lys Ile Tyr Tyr Phe  
130 135 140

Ala Pro Glu Thr Val Gln Ser Leu Ile Ser Ser Ser Val Arg Gln Ala  
145 150 155 160

Leu Glu Gln Pro Leu Asn Tyr Ala Arg Asn Tyr Leu Ala Asp Leu Leu  
165 170 175

Glu Pro Cys Val Lys Arg Val Ile Tyr Leu Asp Ser Asp Leu Val Val  
180 185 190

Val Asp Asp Ile Val Lys Leu Trp Lys Thr Gly Leu Gly Gln Arg Thr  
195 200 205

Ile Gly Ala Pro Glu Tyr Cys His Ala Asn Phe Thr Lys Tyr Phe Thr  
210 215 220

Gly Gly Phe Trp Ser Asp Lys Arg Phe Asn Gly Thr Phe Lys Gly Arg  
225 230 235 240

Asn Pro Cys Tyr Phe Asn Thr Gly Val Met Val Ile Asp Leu Lys Lys  
245 250 255

Trp Arg Gln Phe Arg Phe Thr Lys Arg Ile Glu Lys Trp Met Glu Ile  
260 265 270

Gln Lys Ile Glu Arg Ile Tyr Glu Leu Gly Ser Leu Pro Pro Phe Leu  
275 280 285

Leu Val Phe Ala Gly His Val Ala Pro Ile Ser His Arg Trp Asn Gln  
290 295 300

His Gly Leu Gly Gly Asp Asn Val Arg Gly Ser Cys Arg Asp Leu His  
305 310 315 320

Ser Gly Pro Val Ser Leu Leu His Trp Ser Gly Ser Gly Lys Pro Trp  
325 330 335

Leu Arg Leu Asp Ser Lys Leu Pro Cys Pro Leu Asp Thr Leu Trp Ala  
340 345 350

Pro Tyr Asp Leu Tyr Lys His Ser His  
355 360

<210> 33  
<211> 1038  
<212> DNA  
<213> *Arabidopsis thaliana*

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agagaatgct ccaaaaacgac atggataacct tcggatcacg aacacaaccc atcaatcatc 180  
cacatcgcta tgactctcga cgcaatttac ctccgtggct cagtcgccgg cgtcttctcc 240  
gttctccaac acgcttcttg tcctgaaaac atcggtttcc acttcatcgc cactcaccgt 300  
cgcagcgccg atctccgccc cataatctcc tcaacattcc catacctaac ctaccacatt 360  
taccattttgc accctaacct cgtccgcagc aaaatatctt cctctattcg tcgtgcttta 420  
gaccaaccgt taaactacgc tcggatctac ctcgcccgtc tcctcccaat cgccgtccgc 480  
cgcgtaatct acttcgactc cgatctcgta gtcgtcgatg acgtggctaa actctggaga 540  
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tacttcactt caagattctg gtcgagtc当地 gtttacaaat cggcggtgaa agataggaaa 660  
ccgtgttatt tcaacaccgg agtgatggtg attgatctcg gaaaatggag agaaaggaga 720  
gtcacggta agctagagac atggatgagg attcaaaaac gacatcgtat ttacgaattt 780  
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tggaatcagc atggatctgg tggatgataac ttggaaaggac tttgccccaa tttgcattca 900  
ggtccggta gtttggca ttggagcggg aaaggaaac catggctaaag gcttgactcg 960  
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ttgatctctg atagctga 1038

<210> 34  
 <211> 345  
 <212> PRT  
 <213> Arabidopsis thaliana  
  
 <400> 34  
  
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 20 25 30  
  
 Glu Ala Pro Ala Phe Arg Asn Gly Arg Glu Cys Ser Lys Thr Thr Trp  
 35 40 45  
  
 Ile Pro Ser Asp His Glu His Asn Pro Ser Ile Ile His Ile Ala Met  
 50 55 60  
  
 Thr Leu Asp Ala Ile Tyr Leu Arg Gly Ser Val Ala Gly Val Phe Ser  
 65 70 75 80  
  
 Val Leu Gln His Ala Ser Cys Pro Glu Asn Ile Val Phe His Phe Ile  
 85 90 95  
  
 Ala Thr His Arg Arg Ser Ala Asp Leu Arg Arg Ile Ile Ser Ser Thr  
 100 105 110  
  
 Phe Pro Tyr Leu Thr Tyr His Ile Tyr His Phe Asp Pro Asn Leu Val  
 115 120 125  
  
 Arg Ser Lys Ile Ser Ser Ser Ile Arg Arg Ala Leu Asp Gln Pro Leu  
 130 135 140  
  
 Asn Tyr Ala Arg Ile Tyr Leu Ala Asp Leu Leu Pro Ile Ala Val Arg  
 145 150 155 160  
  
 Arg Val Ile Tyr Phe Asp Ser Asp Leu Val Val Val Asp Asp Val Ala  
 165 170 175  
  
 Lys Leu Trp Arg Ile Asp Leu Arg Arg His Val Val Gly Ala Pro Glu  
 180 185 190  
  
 Tyr Cys His Ala Asn Phe Thr Asn Tyr Phe Thr Ser Arg Phe Trp Ser  
 195 200 205  
  
 Ser Gln Gly Tyr Lys Ser Ala Leu Lys Asp Arg Lys Pro Cys Tyr Phe  
 210 215 220

Asn Thr Gly Val Met Val Ile Asp Leu Gly Lys Trp Arg Glu Arg Arg  
225 230 235 240

Val Thr Val Lys Leu Glu Thr Trp Met Arg Ile Gln Lys Arg His Arg  
245 250 255

Ile Tyr Glu Leu Gly Ser Leu Pro Pro Phe Leu Leu Val Phe Ala Gly  
260 265 270

Asp Val Glu Pro Val Glu His Arg Trp Asn Gln His Gly Leu Gly Gly  
275 280 285

Asp Asn Leu Glu Gly Leu Cys Arg Asn Leu His Pro Gly Pro Val Ser  
290 295 300

Leu Leu His Trp Ser Gly Lys Gly Lys Pro Trp Leu Arg Leu Asp Ser  
305 310 315 320

Arg Arg Pro Cys Pro Leu Asp Ser Leu Trp Ala Pro Tyr Asp Leu Phe  
325 330 335

Arg Tyr Ser Pro Leu Ile Ser Asp Ser  
340 345

<210> 35

<211> 1056

<212> DNA

<213> *Arabidopsis thaliana*

<400> 35

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tgcgccttaa tcgatgactc cgagtccgac gatgacgtgg tcgccaaacc aatcttctgc 180

tcacgtcgag ctgtccacgt ggcgatgaca ctcgacgccc cctacattcg tggctcagtc 240

gccgctgttc tctccgtcct ccaacactct tcttgtcctg aaaacattgt tttccacttc 300

gtcgcccttg cttccgcccga cgcttcttcc ttacgagcca ccataccctc ctcttccct 360

taccttgatt tcaccgtcta cgtcttcaac gtctcctccg tctctcgct tatctcctcc 420

tctatccgct ccgcactaga ctgtccttta aactacgcaa gaagctacct cgccgatctc 480

ctccctccct gcgtccgccc cgtcgtctac ctagactccg atctgatcct cgtcgacgac 540

atagcaaaaac tcgcccac agatctcgac cgtgattcag tcctcgccgc gccgaaatac 600

tgcaacgcca atttcacttc atacttcaca tcaaccttct ggtctaatcc gactctctct 660

ttaaccctcg	ccgatcgaa	agcatgtac	ttcaaacactg	gagtcatgg	gatcgatctt	720
tcccggtggc	gcgaaggcgc	gtacacgtca	cgcacgtcaag	agtggatggc	gatgcaaaag	780
agaatgagaa	tttacgagct	tggttcgta	ccaccgtttt	tattggttt	tgccggttg	840
attaaaccgg	ttaatcatcg	gtgaaaccaa	cacggtttag	gaggtgataa	tttcagagga	900
ctgtgttagag	atctccatcc	tggtccggtg	agtcgttgc	attggagtgg	gaaaggtaag	960
ccatgggcta	ggcttgatgc	tggtcggcct	tgtcccttag	acgcgccttg	ggctccgtat	1020
gatcttcttc	aaacgcccgtt	cgcgttggat	tctgta			1056

<210> 36  
<211> 351  
<212> PRT  
<213> Arabidopsis thaliana

<400> 36

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His	Lys	Pro	Ile	Ser	Ala	Thr	Thr	Ile	Ile	Gln	Lys	Phe	Lys	Glu	Ala
			20					25					30		

Pro	Gln	Phe	Tyr	Asn	Ser	Ala	Asp	Cys	Pro	Leu	Ile	Asp	Asp	Ser	Glu
				35			40					45			

Ser	Asp	Asp	Asp	Val	Val	Ala	Lys	Pro	Ile	Phe	Cys	Ser	Arg	Arg	Ala
				50		55					60				

Val	His	Val	Ala	Met	Thr	Leu	Asp	Ala	Ala	Tyr	Ile	Arg	Gly	Ser	Val
				65		70				75				80	

Ala	Ala	Val	Leu	Ser	Val	Leu	Gln	His	Ser	Ser	Cys	Pro	Glu	Asn	Ile
				85				90					95		

Val	Phe	His	Phe	Val	Ala	Ser	Ala	Ser	Ala	Asp	Ala	Ser	Ser	Leu	Arg
				100			105					110			

Ala	Thr	Ile	Ser	Ser	Ser	Phe	Pro	Tyr	Leu	Asp	Phe	Thr	Val	Tyr	Val
				115			120					125			

Phe	Asn	Val	Ser	Ser	Val	Ser	Arg	Leu	Ile	Ser	Ser	Ile	Arg	Ser	
					130		135				140				

Ala	Leu	Asp	Cys	Pro	Leu	Asn	Tyr	Ala	Arg	Ser	Tyr	Leu	Ala	Asp	Leu
				145			150			155			160		

Leu Pro Pro Cys Val Arg Arg Val Val Tyr Leu Asp Ser Asp Leu Ile  
165 170 175

Leu Val Asp Asp Ile Ala Lys Leu Ala Ala Thr Asp Leu Gly Arg Asp  
180 185 190

Ser Val Leu Ala Ala Pro Glu Tyr Cys Asn Ala Asn Phe Thr Ser Tyr  
195 200 205

Phe Thr Ser Thr Phe Trp Ser Asn Pro Thr Leu Ser Leu Thr Phe Ala  
210 215 220

Asp Arg Lys Ala Cys Tyr Phe Asn Thr Gly Val Met Val Ile Asp Leu  
225 230 235 240

Ser Arg Trp Arg Glu Gly Ala Tyr Thr Ser Arg Ile Glu Glu Trp Met  
245 250 255

Ala Met Gln Lys Arg Met Arg Ile Tyr Glu Leu Gly Ser Leu Pro Pro  
260 265 270

Phe Leu Leu Val Phe Ala Gly Leu Ile Lys Pro Val Asn His Arg Trp  
275 280 285

Asn Gln His Gly Leu Gly Gly Asp Asn Phe Arg Gly Leu Cys Arg Asp  
290 295 300

Leu His Pro Gly Pro Val Ser Leu Leu His Trp Ser Gly Lys Gly Lys  
305 310 315 320

Pro Trp Ala Arg Leu Asp Ala Gly Arg Pro Cys Pro Leu Asp Ala Leu  
325 330 335

Trp Ala Pro Tyr Asp Leu Leu Gln Thr Pro Phe Ala Leu Asp Ser  
340 345 350

<210> 37  
<211> 1182  
<212> DNA  
<213> Arabidopsis thaliana

<400> 37  
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ggtatacggg tgattccggc gaggatcacg agtgtcggtg atggcggcgg cggaggaggt 120  
aataatgggt ttagtaaact tggtccgttt atggaagctc cggagtatag aaacggcaag 180

gagtgtgtat	cttcatcagt	gaacagagag	aacttcgtgt	cgttttttc	tagttcta	240
gatccttcgc	ttgttcacat	cgctatgact	ttggactcag	agtatctccg	tggatcaatc	300
gcagccgttc	attctgttct	tcgccacgcg	tcttgtccag	agaacgtctt	cttccatttc	360
atcgctgctg	agtttgactc	tgcgagtcct	cgtgttctga	gtcaactcgt	gagggtcgact	420
tttccttcgt	tgaactttaa	agtctacatt	tttaggaaag	atacggtgat	caatctcata	480
tcttcttcga	tttagactagc	tttggagaat	ccgttgaact	atgctcgaa	ctatctcgga	540
gatattcttg	atcgaagtgt	tgaacgagtc	atttatcttgc	actcggatgt	tataactgtg	600
gatgatatca	caaagcttg	gaacacgggtt	ttgaccgggt	cacgagtcat	cgagactccg	660
gagtattgtc	acgcgaactt	cactcagtat	ttcacttccg	ggttctggtc	agacccggct	720
ttaccgggtc	taatctcggg	tcaaaagcct	tgctatttca	acacaggagt	gatggtgatg	780
gatcttgtta	gatggagaga	agggaaattac	agagagaagt	tagagcaatg	gatgcaattt	840
cagaagaaga	tgagaatcta	cgatcttgg	tcattaccac	cgtttctttt	ggtgtttgcg	900
ggtaatgttgc	aagctatttgc	tcatagatgg	aaccaacatg	gtttaggagg	agacaatata	960
cgaggaagtt	gtcggcattt	gcattcctgg	cctgtgagct	tgttgcatttgc	gagtggtaaa	1020
ggtaagccat	gggttagact	tgtgagaag	aggccttgc	cgttggatca	tctttggag	1080
ccatattgatt	tgtataagca	taagatttgc	agagctaaag	atcagtcct	gcttgggttt	1140
gcttctctgt	cgaggttgac	tgtgattca	agcttcttgc	ga		1182

<210> 38

<211> 393

<212> PRT

<213> *Arabidopsis thaliana*

<400> 38

Met	Ser	Ser	Arg	Phe	Ser	Leu	Thr	Val	Val	Cys	Leu	Ile	Ala	Leu	Leu
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Pro	Phe	Val	Val	Gly	Ile	Arg	Leu	Ile	Pro	Ala	Arg	Ile	Thr	Ser	Val
				20				25				30			

Gly	Asp	Gly	Gly	Gly	Gly	Gly	Asn	Asn	Gly	Phe	Ser	Lys	Leu	Gly	.
		35				40					45				

Pro	Phe	Met	Glu	Ala	Pro	Glu	Tyr	Arg	Asn	Gly	Lys	Glu	Cys	Val	Ser
		50				55				60					

Ser	Ser	Val	Asn	Arg	Glu	Asn	Phe	Val	Ser	Ser	Ser	Ser	Ser	Asn	.
		65			70				75				80		

Asp Pro Ser Leu Val His Ile Ala Met Thr Leu Asp Ser Glu Tyr Leu  
85 90 95

Arg Gly Ser Ile Ala Ala Val His Ser Val Leu Arg His Ala Ser Cys  
100 105 110

Pro Glu Asn Val Phe Phe His Phe Ile Ala Ala Glu Phe Asp Ser Ala  
115 120 125

Ser Pro Arg Val Leu Ser Gln Leu Val Arg Ser Thr Phe Pro Ser Leu  
130 135 140

Asn Phe Lys Val Tyr Ile Phe Arg Glu Asp Thr Val Ile Asn Leu Ile  
145 150 155 160

Ser Ser Ser Ile Arg Leu Ala Leu Glu Asn Pro Leu Asn Tyr Ala Arg  
165 170 175

Asn Tyr Leu Gly Asp Ile Leu Asp Arg Ser Val Glu Arg Val Ile Tyr  
180 185 190

Leu Asp Ser Asp Val Ile Thr Val Asp Asp Ile Thr Lys Leu Trp Asn  
195 200 205

Thr Val Leu Thr Gly Ser Arg Val Ile Gly Ala Pro Glu Tyr Cys His  
210 215 220

Ala Asn Phe Thr Gln Tyr Phe Thr Ser Gly Phe Trp Ser Asp Pro Ala  
225 230 235 240

Leu Pro Gly Leu Ile Ser Gly Gln Lys Pro Cys Tyr Phe Asn Thr Gly  
245 250 255

Val Met Val Met Asp Leu Val Arg Trp Arg Glu Gly Asn Tyr Arg Glu  
260 265 270

Lys Leu Glu Gln Trp Met Gln Leu Gln Lys Lys Met Arg Ile Tyr Asp  
275 280 285

Leu Gly Ser Leu Pro Pro Phe Leu Leu Val Phe Ala Gly Asn Val Glu  
290 295 300

Ala Ile Asp His Arg Trp Asn Gln His Gly Leu Gly Gly Asp Asn Ile  
305 310 315 320

Arg Gly Ser Cys Arg Ser Leu His Pro Gly Pro Val Ser Leu Leu His  
325 330 335

Trp Ser Gly Lys Gly Lys Pro Trp Val Arg Leu Asp Glu Lys Arg Pro  
340 345 350

Cys Pro Leu Asp His Leu Trp Glu Pro Tyr Asp Leu Tyr Lys His Lys  
355 360 365

Ile Glu Arg Ala Lys Asp Gln Ser Leu Leu Gly Phe Ala Ser Leu Ser  
370 375 380

Glu Leu Thr Asp Asp Ser Ser Phe Leu  
385 390

<210> 39  
<211> 1173  
<212> DNA  
<213> Arabidopsis thaliana

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aaggagtgcg tgtctcaatc gttgaacaga gaaaacttcg tgtcgtcttg cgacgcttcg 240  
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cattcaatgc tccgccacgc gtcgtgtcca gaaaacgtct tcttccatct catcgctgca 360  
gagtttgacc cggcgagtcc acgcgttctg agtcaactcg tccgatctac tttccgtcg 420  
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20	25	30	
Gly Arg Leu Thr Ala Val Ser Ala Thr Val Gly Asn Gly Phe Asp Leu			
35	40	45	
Gly Ser Phe Val Glu Ala Pro Glu Tyr Arg Asn Gly Lys Glu Cys Val			
50	55	60	
Ser Gln Ser Leu Asn Arg Glu Asn Phe Val Ser Ser Cys Asp Ala Ser			
65	70	75	80
Leu Val His Val Ala Met Thr Leu Asp Ser Glu Tyr Leu Arg Gly Ser			
85	90	95	
Ile Ala Ala Val His Ser Met Leu Arg His Ala Ser Cys Pro Glu Asn			
100	105	110	
Val Phe Phe His Leu Ile Ala Ala Glu Phe Asp Pro Ala Ser Pro Arg			
115	120	125	
Val Leu Ser Gln Leu Val Arg Ser Thr Phe Pro Ser Leu Asn Phe Lys			
130	135	140	
Val Tyr Ile Phe Arg Glu Asp Thr Val Ile Asn Leu Ile Ser Ser Ser			
145	150	155	160
Ile Arg Gln Ala Leu Glu Asn Pro Leu Asn Tyr Ala Arg Asn Tyr Leu			
165	170	175	
Gly Asp Ile Leu Asp Pro Cys Val Asp Arg Val Ile Tyr Leu Asp Ser			
180	185	190	

Asp Ile Ile Val Val Asp Asp Ile Thr Lys Leu Trp Asn Thr Ser Leu  
195 200 205

Thr Gly Ser Arg Ile Ile Gly Ala Pro Glu Tyr Cys His Ala Asn Phe  
210 215 220

Thr Lys Tyr Phe Thr Ser Gly Phe Trp Ser Asp Pro Ala Leu Pro Gly  
225 230 235 240

Phe Phe Ser Gly Arg Lys Pro Cys Tyr Phe Asn Thr Gly Val Met Val  
245 250 255

Met Asp Leu Val Arg Trp Arg Glu Gly Asn Tyr Arg Glu Lys Leu Glu  
260 265 270

Thr Trp Met Gln Ile Gln Lys Lys Arg Ile Tyr Asp Leu Gly Ser  
275 280 285

Leu Pro Pro Phe Leu Leu Val Phe Ala Gly Asn Val Glu Ala Ile Asp  
290 295 300

His Arg Trp Asn Gln His Gly Leu Gly Gly Asp Asn Val Arg Gly Ser  
305 310 315 320

Cys Arg Ser Leu His Lys Gly Pro Val Ser Leu Leu His Trp Ser Gly  
325 330 335

Lys Gly Lys Pro Trp Val Arg Leu Asp Glu Lys Arg Pro Cys Pro Leu  
340 345 350

Asp His Leu Trp Glu Pro Tyr Asp Leu Tyr Glu His Lys Ile Glu Arg  
355 360 365

Ala Lys Asp Gln Ser Leu Phe Gly Phe Ser Ser Leu Ser Glu Leu Thr  
370 375 380

Glu Asp Ser Ser Phe Phe  
385 390

<210> 41  
<211> 1056  
<212> DNA  
<213> Arabidopsis thaliana

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cgtgaggctg	atcagattca	tatcgccatg	actctcgaca	caaactacct	ccgtggcaca	240
atggctgccg	ttttgtctct	ccttcaacat	tccacttgcc	ctgaaaacct	ctctttcat	300
ttcctgtccc	ttcctcattt	cgaaaacgac	ctttcacca	gcatcaaatac	aacctttct	360
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cacgcaaact	tcacccatta	tttcacaaga	actttctgg	cagacccgg	attggtcaaa	660
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aaatggagga	aaggaatgta	tacacagaag	gtagaagagt	ggatgacaat	tcagaagcag	780
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tgtagaacgt	tgcattccggg	accataagt	cttcttcaact	ggagtggaaa	agggaaagcca	960
tggtaagac	tagattcaag	gaagccttgt	atcggtgatc	atctatggc	accgtatgat	1020
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 <211> 351  
 <212> PRT  
 <213> *Arabidopsis thaliana*

<400> 42

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					20			25			30			

Val	Ile	Leu	His	Lys	Pro	Ser	Ala	Pro	Thr	Leu	Pro	Val	Phe	Arg	Glu
					35			40			45				

Ala	Pro	Ala	Phe	Arg	Asn	Gly	Asp	Gln	Cys	Gly	Thr	Arg	Glu	Ala	Asp
					50			55			60				

Gln	Ile	His	Ile	Ala	Met	Thr	Leu	Asp	Thr	Asn	Tyr	Leu	Arg	Gly	Thr
					65			70			75			80	

Met Ala Ala Val Leu Ser Leu Leu Gln His Ser Thr Cys Pro Glu Asn

85

90

95

Leu Ser Phe His Phe Leu Ser Leu Pro His Phe Glu Asn Asp Leu Phe  
 100 105 110

Thr Ser Ile Lys Ser Thr Phe Pro Tyr Leu Asn Phe Lys Ile Tyr Gln  
 115 120 125

Phe Asp Pro Asn Leu Val Arg Ser Lys Ile Ser Lys Ser Ile Arg Gln  
 130 135 140

Ala Leu Asp Gln Pro Leu Asn Tyr Ala Arg Ile Tyr Leu Ala Asp Ile  
 145 150 155 160

Ile Pro Ser Ser Val Asp Arg Ile Ile Tyr Leu Asp Ser Asp Leu Val  
 165 170 175

Val Val Asp Asp Ile Glu Lys Leu Trp His Val Glu Met Glu Gly Lys  
 180 185 190

Val Val Ala Ala Pro Glu Tyr Cys His Ala Asn Phe Thr His Tyr Phe  
 195 200 205

Thr Arg Thr Phe Trp Ser Asp Pro Val Leu Val Lys Val Leu Glu Gly  
 210 215 220

Lys Arg Pro Cys Tyr Phe Asn Thr Gly Val Met Val Val Asp Val Asn  
 225 230 235 240

Lys Trp Arg Lys Gly Met Tyr Thr Gln Lys Val Glu Glu Trp Met Thr  
 245 250 255

Ile Gln Lys Gln Lys Arg Ile Tyr His Leu Gly Ser Leu Pro Pro Phe  
 260 265 270

Leu Leu Ile Phe Ala Gly Asp Ile Lys Ala Val Asn His Arg Trp Asn  
 275 280 285

Gln His Gly Leu Gly Gly Asp Asn Phe Glu Gly Arg Cys Arg Thr Leu  
 290 295 300

His Pro Gly Pro Ile Ser Leu Leu His Trp Ser Gly Lys Gly Lys Pro  
 305 310 315 320

Trp Leu Arg Leu Asp Ser Arg Lys Pro Cys Ile Val Asp His Leu Trp  
 325 330 335

Ala Pro Tyr Asp Leu Tyr Arg Ser Ser Arg His Ser Leu Glu Glu  
340 345 350

<210> 43  
<211> 1098  
<212> DNA  
<213> Arabidopsis thaliana

<400> 43  
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gatttaatgg aagctccagc atatcaaaac ggtcttgatt gctctgtttt agccaaaaac 180  
agactcttgt tagcttgcgtg tccatcagct gttcatatag ctatgactct agatccagct 240  
tacttgcgtg gcacggtatac tgcaagtacat tccatcctca aacacacttc ttgccctgaa 300  
aacatcttct tccacttcat tgcttcgggt acaagtcagg gttccctcgc caagacccta 360  
tcctctgttt ttcccttctt gagttcaaa gtctatacct ttgaagaaac cacggtaag 420  
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tacttatccg agattcttcc ttctgtgttt agtcgagtga tttatctcga ttccggatgtg 540  
attgtggtcg atgatattca gaaactatgg aagatttctt tatccgggtc aagaacaatc 600  
ggtgccaccag agtattgcca cgcaaatttc accaaatact tcacagatag tttctggtcc 660  
gatcaaaaac tctcgagtgt ctccgattcc aagactcctt gttatttcaa cacaggagtg 720  
atggttatcg atttagagcg atggagagaa ggagattaca cgagaaagat cgaaaactgg 780  
atgaagattc agaaagaaga taagagaatc tacgaattgg gttctttacc accgtttctt 840  
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gagtttagaaa ttctttga 1098

<210> 44  
<211> 365  
<212> PRT  
<213> Arabidopsis thaliana

<400> 44

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Asp	Ser	Phe	Asp	Asp	Ala	Ser	Ser	Asp	Leu	Met	Glu	Ala	Pro	Ala	Tyr
35							40				45				
Gln	Asn	Gly	Leu	Asp	Cys	Ser	Val	Leu	Ala	Lys	Asn	Arg	Leu	Leu	Leu
50						55				60					
Ala	Cys	Asp	Pro	Ser	Ala	Val	His	Ile	Ala	Met	Thr	Leu	Asp	Pro	Ala
65						70				75			80		
Tyr	Leu	Arg	Gly	Thr	Val	Ser	Ala	Val	His	Ser	Ile	Leu	Lys	His	Thr
85									90				95		
Ser	Cys	Pro	Glu	Asn	Ile	Phe	Phe	His	Phe	Ile	Ala	Ser	Gly	Thr	Ser
100								105					110		
Gln	Gly	Ser	Leu	Ala	Lys	Thr	Leu	Ser	Ser	Val	Phe	Pro	Ser	Leu	Ser
115							120					125			
Phe	Lys	Val	Tyr	Thr	Phe	Glu	Glu	Thr	Thr	Val	Lys	Asn	Leu	Ile	Ser
130						135					140				
Ser	Ser	Ile	Arg	Gln	Ala	Leu	Asp	Ser	Pro	Leu	Asn	Tyr	Ala	Arg	Ser
145						150				155			160		
Tyr	Leu	Ser	Glu	Ile	Leu	Ser	Ser	Cys	Val	Ser	Arg	Val	Ile	Tyr	Leu
165									170				175		
Asp	Ser	Asp	Val	Ile	Val	Val	Asp	Asp	Ile	Gln	Lys	Leu	Trp	Lys	Ile
180								185					190		
Ser	Leu	Ser	Gly	Ser	Arg	Thr	Ile	Gly	Ala	Pro	Glu	Tyr	Cys	His	Ala
195								200				205			
Asn	Phe	Thr	Lys	Tyr	Phe	Thr	Asp	Ser	Phe	Trp	Ser	Asp	Gln	Lys	Leu
210						215					220				
Ser	Ser	Val	Phe	Asp	Ser	Lys	Thr	Pro	Cys	Tyr	Phe	Asn	Thr	Gly	Val
225						230				235				240	
Met	Val	Ile	Asp	Leu	Glu	Arg	Trp	Arg	Glu	Gly	Asp	Tyr	Thr	Arg	Lys
245									250				255		

Ile Glu Asn Trp Met Lys Ile Gln Lys Glu Asp Lys Arg Ile Tyr Glu  
260 265 270

Leu Gly Ser Leu Pro Pro Phe Leu Leu Val Phe Gly Gly Asp Ile Glu  
275 280 285

Ala Ile Asp His Gln Trp Asn Gln His Gly Leu Gly Gly Asp Asn Ile  
290 295 300

Val Ser Ser Cys Arg Ser Leu His Pro Gly Pro Val Ser Leu Ile His  
305 310 315 320

Trp Ser Gly Lys Gly Lys Pro Trp Val Arg Leu Asp Asp Gly Lys Pro  
325 330 335

Cys Pro Ile Asp Tyr Leu Trp Ala Pro Tyr Asp Leu His Lys Ser Gln  
340 345 350

Arg Gln Tyr Leu Gln Tyr Asn Gln Glu Leu Glu Ile Leu  
355 360 365

<210> 45  
<211> 1026  
<212> DNA  
<213> Arabidopsis thaliana

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aaaaacgatg aagatttcgt ttgttcagac aaagccatcc acgtggcaat gaccttagac 180  
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atcatagagt ggatggagtt acaaaaacgg ataagaatct acgagttagg ctctttacca 780  
ccgttttac ttgtcttcgc cgaaacata gctccggtag atcaccggtg gaaccaacac 840

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agttaa 1026

<210> 46  
<211> 341  
<212> PRT  
<213> Arabidopsis thaliana

<400> 46

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Val Ser Phe Ala Gly Gly Glu Arg Phe Lys Glu Ala Pro Lys Phe Phe  
20 25 30

Asn Ser Pro Glu Cys Leu Thr Ile Glu Asn Asp Glu Asp Phe Val Cys  
35 40 45

Ser Asp Lys Ala Ile His Val Ala Met Thr Leu Asp Thr Ala Tyr Leu  
50 55 60

Arg Gly Ser Met Ala Val Ile Leu Ser Val Leu Gln His Ser Ser Cys  
65 70 75 80

Pro Gln Asn Ile Val Phe His Phe Val Thr Ser Lys Gln Ser His Arg  
85 90 95

Leu Gln Asn Tyr Val Val Ala Ser Phe Pro Tyr Leu Lys Phe Arg Ile  
100 105 110

Tyr Pro Tyr Asp Val Ala Ala Ile Ser Gly Leu Ile Ser Thr Ser Ile  
115 120 125

Arg Ser Ala Leu Asp Ser Pro Leu Asn Tyr Ala Arg Asn Tyr Leu Ala  
130 135 140

Asp Ile Leu Pro Thr Cys Leu Ser Arg Val Val Tyr Leu Asp Ser Asp  
145 150 155 160

Leu Ile Leu Val Asp Asp Ile Ser Lys Leu Phe Ser Thr His Ile Pro  
165 170 175

Thr Asp Val Val Leu Ala Ala Pro Glu Tyr Cys Asn Ala Asn Phe Thr

180

185

190

Thr Tyr Phe Thr Pro Thr Phe Trp Ser Asn Pro Ser Leu Ser Ile Thr  
195 200 205

Leu Ser Leu Asn Arg Arg Ala Thr Pro Cys Tyr Phe Asn Thr Gly Val  
210 215 220

Met Val Ile Glu Leu Lys Lys Trp Arg Glu Gly Asp Tyr Thr Arg Lys  
225 230 235 240

Ile Ile Glu Trp Met Glu Leu Gln Lys Arg Ile Arg Ile Tyr Glu Leu  
245 250 255

Gly Ser Leu Pro Pro Phe Leu Leu Val Phe Ala Gly Asn Ile Ala Pro  
260 265 270

Val Asp His Arg Trp Asn Gln His Gly Leu Gly Gly Asp Asn Phe Arg  
275 280 285

Gly Leu Cys Arg Asp Leu His Pro Gly Pro Val Ser Leu Leu His Trp  
290 295 300

Ser Gly Lys Gly Lys Pro Trp Val Arg Leu Asp Asp Gly Arg Pro Cys  
305 310 315 320

Pro Leu Asp Ala Leu Trp Val Pro Tyr Asp Leu Leu Glu Ser Arg Phe  
325 330 335

Asp Leu Ile Glu Ser  
340

<210> 47  
<211> 1086  
<212> DNA  
<213> Arabidopsis thaliana

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ggtccggta gcttgcttca ttggccggt agtggtaaac cgtggttcg gttagattcg	1020
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cgctga	1086

<210> 48

<211> 361

<212> PRT

<213> Arabidopsis thaliana

<400> 48

Met Leu Trp Ile Met Arg Phe Ser Gly Leu Phe Ser Ala Ala Leu Val			
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Ile Ile Val Leu Ser Pro Ser Leu Gln Ser Phe Pro Pro Ala Glu Ala			
20	25	30	

Ile Arg Ser Ser His Leu Asp Ala Tyr Leu Arg Phe Pro Ser Ser Asp			
35	40	45	

Pro Pro Pro His Arg Phe Ser Phe Arg Lys Ala Pro Val Phe Arg Asn			
50	55	60	

Ala Ala Asp Cys Ala Ala Asp Ile Asp Ser Gly Val Cys Asn Pro			
65	70	75	80

Ser Leu Val His Val Ala Ile Thr Leu Asp Phe Glu Tyr Leu Arg Gly			
85	90	95	

Ser Ile Ala Ala Val His Ser Ile Leu Lys His Ser Ser Cys Pro Glu			
100	105	110	

Ser Val Phe Phe His Phe Leu Val Ser Glu Thr Asp Leu Glu Ser Leu  
115 120 125

Ile Arg Ser Thr Phe Pro Glu Leu Lys Leu Lys Val Tyr Tyr Phe Asp  
130 135 140

Pro Glu Ile Val Arg Thr Leu Ile Ser Thr Ser Val Arg Gln Ala Leu  
145 150 155 160

Glu Gln Pro Leu Asn Tyr Ala Arg Asn Tyr Leu Ala Asp Leu Leu Glu  
165 170 175

Pro Cys Val Arg Arg Val Ile Tyr Leu Asp Ser Asp Leu Ile Val Val  
180 185 190

Asp Asp Ile Ala Lys Leu Trp Met Thr Lys Leu Gly Ser Lys Thr Ile  
195 200 205

Gly Ala Pro Glu Tyr Cys His Ala Asn Phe Thr Lys Tyr Phe Thr Pro  
210 215 220

Ala Phe Trp Ser Asp Glu Arg Phe Ser Gly Ala Phe Ser Gly Arg Lys  
225 230 235 240

Pro Cys Tyr Phe Asn Thr Gly Val Met Val Met Asp Leu Glu Arg Trp  
245 250 255

Arg Arg Val Gly Tyr Thr Glu Val Ile Glu Lys Trp Met Glu Ile Gln  
260 265 270

Lys Ser Asp Arg Ile Tyr Glu Leu Gly Ser Leu Pro Pro Phe Leu Leu  
275 280 285

Val Phe Ala Gly Glu Val Ala Pro Ile Glu His Arg Trp Asn Gln His  
290 295 300

Gly Leu Gly Gly Asp Asn Val Arg Gly Ser Cys Arg Asp Leu His Pro  
305 310 315 320

Gly Pro Val Ser Leu Leu His Trp Ser Gly Ser Gly Lys Pro Trp Phe  
325 330 335

Arg Leu Asp Ser Arg Arg Pro Cys Pro Leu Asp Thr Leu Trp Ala Pro  
340 345 350

Tyr Asp Leu Tyr Gly His Tyr Ser Arg  
355 360

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<211> 1041  
<212> DNA  
<213> Arabidopsis thaliana

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cacgcgaatt tcacgaaata cttcaccgga ggattctggt cggaggagag attctccgg 660  
accttttagag ggaggaagcc atgttacttc aacacaggtg tggatgttgc agatcttaag 720  
aaatggagaa gaggtggta cacgaaacgt atcgagaaat ggatggagat tcagagaaga 780  
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tgtcggtt tgcatttcgg tcctgtgagt ttgtgcatt ggtctggtag tggcaagccc 960  
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ttgtatcgac attcgattt a 1041

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<211> 346  
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Val Ile Val Leu Ser Pro Ser Leu Gln Ser Phe Pro Pro Ala Ala Ala  
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Ile	Arg	Ser	Ser	Pro	Ser	Pro	Ile	Phe	Arg	Lys	Ala	Pro	Ala	Val	Phe
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Asn	Asn	Gly	Asp	Glu	Cys	Leu	Ser	Ser	Gly	Gly	Val	Cys	Asn	Pro	Ser
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Leu	Val	His	Val	Ala	Ile	Thr	Leu	Asp	Val	Glu	Tyr	Leu	Arg	Gly	Ser
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Ile	Ala	Ala	Val	Asn	Ser	Ile	Leu	Gln	His	Ser	Val	Cys	Pro	Glu	Ser
85								90						95	
Val	Phe	Phe	His	Phe	Ile	Ala	Val	Ser	Glu	Glu	Thr	Asn	Leu	Leu	Glu
100								105						110	
Ser	Leu	Val	Arg	Ser	Val	Phe	Pro	Arg	Leu	Lys	Phe	Asn	Ile	Tyr	Asp
115							120						125		
Phe	Ala	Pro	Glu	Thr	Val	Arg	Gly	Leu	Ile	Ser	Ser	Val	Arg	Gln	
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Ala	Leu	Glu	Gln	Pro	Leu	Asn	Tyr	Ala	Arg	Ser	Tyr	Leu	Ala	Asp	Leu
145					150				155					160	
Leu	Glu	Pro	Cys	Val	Asn	Arg	Val	Ile	Tyr	Leu	Asp	Ser	Asp	Leu	Val
165						170								175	
Val	Val	Asp	Asp	Ile	Ala	Lys	Leu	Trp	Lys	Thr	Ser	Leu	Gly	Ser	Arg
180							185						190		
Ile	Ile	Gly	Ala	Pro	Glu	Tyr	Cys	His	Ala	Asn	Phe	Thr	Lys	Tyr	Phe
195							200						205		
Thr	Gly	Gly	Phe	Trp	Ser	Glu	Glu	Arg	Phe	Ser	Gly	Thr	Phe	Arg	Gly
210						215					220				
Arg	Lys	Pro	Cys	Tyr	Phe	Asn	Thr	Gly	Val	Met	Val	Ile	Asp	Leu	Lys
225						230				235					240
Lys	Trp	Arg	Arg	Gly	Gly	Tyr	Thr	Lys	Arg	Ile	Glu	Lys	Trp	Met	Glu
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Ile	Gln	Arg	Arg	Glu	Arg	Ile	Tyr	Glu	Leu	Gly	Ser	Leu	Pro	Pro	Phe
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Leu Leu Val Phe Ser Gly His Val Ala Pro Ile Ser His Arg Trp Asn  
275 280 285

Gln His Gly Leu Gly Gly Asp Asn Val Arg Gly Ser Cys Arg Asp Leu  
290 295 300

His Pro Gly Pro Val Ser Leu Leu His Trp Ser Gly Ser Gly Lys Pro  
305 310 315 320

Trp Ile Arg Leu Asp Ser Lys Arg Pro Cys Pro Leu Asp Ala Leu Trp  
325 330 335

Thr Pro Tyr Asp Leu Tyr Arg His Ser His  
340 345